German.	*Dutch.*	*Arabic.*	*Brahman.*
Sonntag	Zondag	Youm el ahad	Addita varam
Montag	Maandag	Youm eth thani	Soma varam
Dienstag	Dingsdag	Youm eth thaleth	Mangala varam
Mittwoch	Woensdag	Youm el arbaa	Bouta varam
Donnerstag	Donderdag	Youm el khamis	Brahaspati varam
Freitag	Vrijdag	Youm el djoumaa	Soucra varam
Samstag	Zaturdag	Youm el effabt	Sany varam

Based upon Arago's *Pop. Astronomy*, vol. ii. p. 727.

ART. XII.—*Notes on some of the Physical Appearances Observed in the late Transit of Venus.*

BY R. L. J. ELLERY, F.R.S., F.R.A.S.

[Read 21st December, 1875.]

In these brief notes relating to the physical appearances observed during the transit of Venus, of December 9th, I do not intend to refer, except in a cursory manner, to any of the more mathematical data of the occurrence, for these are not yet fully reduced, and will be only valuable when combined with similar results obtained at other parts of the earth's surface.

The weather in Melbourne, and indeed nearly throughout all Victoria, was very unpromising in the morning of the occurrence; but fortunately the clouds broke away in Melbourne at the very nick of time, so that the first internal contact and some of the preceding phases were well seen. The previous rain and subsequent occasional showers had the effect of rendering the atmosphere exceeding favourable for observation, and, so far as the earlier phases of the transit were concerned, the atmospheric conditions were unusually good; for any one accustomed to observing the sun will know that it is only on such favourable occasions when the sky is seldom clear of clouds that its edge can be observed sharp and clear without what is termed "boiling," so that what was otherwise an unpromising state of the weather, was actually most favourable for observation of the physical appearances of the transit. I dwell upon this fact, because I am of opinion it gives so much more weight to the accounts of the different observers who saw the phenomenon under such conditions.

The first phases seen at the Observatory, or indeed, so far as I am yet informed, anywhere in Victoria, were when the planet was about half or more on the sun's limb. I was observing with an eight-inch refractor, and at my first glimpse Venus was about five-sixths of its diameter on the sun. The first thing that struck me was the remarkable distinctness with which the *whole* disc of Venus was seen, that portion *outside* the sun's limb being nearly as distinct as that *within.* It appeared of the same tone, but was *margined by a bright thin edge of light.*

I propose to give now the statements of other observers with respect to this phenomenon, before referring to any of the subsequent phases.

The late Professor Wilson, observing at Mornington with our beautiful four and a-half "Simm's" Equatorial, remarks respecting this phase :—"About five minutes before internal contact there was an appearance I do not recollect having seen described. The circle of the dark body of Venus was continued and completed outside the edge of the sun, marked out by a narrow luminous arc. There was no doubt about this appearance. I quite satisfied myself that it was not a mere mental continuation of the circle."

At Glenrowan, Mr. Gilbert, observing with four and a-half inch refractor, by Cooke, noted about two and a-quarter minutes before estimated internal contact "the limb of Venus visible outside sun's edge, which appeared luminous, the margin being quite distinct where the luminosity was densest."

Mr. Thomas Harrison, observing at the Observatory with a two three-quarter inch refractor, remarks :—"I several times fancied that the disc of Venus appeared darker than the surrounding glare of the sky, and seemed to trace the dark outline even when the light streak was not visible. The light line or streak outside the planet's disc (represented in sketch), although not of the thickness shown, was scarcely as bright as represented."

Mr. Anketel M. Henderson, observing with a Browning eight and a-half inch Newtonian, notes regarding this phase: —"It cleared about 11.40, and I got my first observation. Definition perfect, not the slightest tremor. At 11.53 or thereabouts I was surprised by seeing the portion of Venus outside the sun distinctly visible on a faint phosphorescent looking background. It remained visible for about 45 seconds, when clouds interfered."

C. Todd, Esq., of Adelaide, observing with an eight inch refractor, by Cooke and Son, remarks:—"For some time after internal contact at egress the portion of the planet which had moved off the sun was distinctly visible, appearing as though seen through a nebulous and luminous haze of a purplish hue, extending beyond and around the edge of the planet, and inclining to violet towards the sun."

I have no notes (except the last) of the visibility of the disc of Venus outside the sun's disc at egress. I could get no trace of it myself, although the sky was clear, and I looked carefully for it.

At Glenrowan the transit was seen earlier than at Melbourne, and when the planet was about two-thirds on the sun, Mr. Gilbert remarked, "N.W. limb slightly luminous." A sketch was given to illustrate this, from which it would appear that that portion of the planet nearest the centre of the sun exhibited on its edge a luminous segment, in the drawing not unlike one of the polar spots on Mars, but less marked and defined.

We now come to the appearances presented at internal contact.

Regarding this phase I find I noted as follows:—"This phase was remarkably well seen, and was almost tangential, and free from any haze, ligament, or other disturbance, the sky remaining clear in the region of the sun till after internal contact was well over."

About 2 min. 30 sec. before contact, limb of sun appeared to bulge out so as to embrace Venus, the outwardly bent cusps continuing around Venus like a thread of silver. The next phases noted were near the time of the first internal contact, when a slight flicker between the limbs of Venus and sun was occasionally visible, then a hazy junction like thin smoke was noticed, and finally a very faint smoky thread appeared to join the two edges. This suddenly disappeard at 0 h. 1 min. 9·4 sec., Melbourne time.

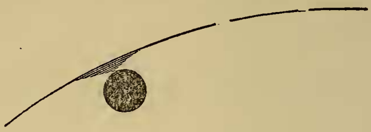
Mr. White, observing with a two and five-eighth inch refractor, remarks:—"At about three minutes before the time of the first internal contact, when I first watched with the altazimuth, Venus was nearly on the sun's limb; the part off the sun was partly embraced by two bright horns stretching out from the surface of the sun. At the phase marked 'estimated tangential' Venus appeared to be attached to the sun by a very broad ligament nearly as black as the planet itself, and the position of the planet was such that if the dark face had been quite circular it would have formed a tangent to the sun's limb. At the phase marked 'Chinaman's cap' the ligament narrowed very much on the side of Venus, the broad part being still attached to the sun's limb. At the phase marked 'bright streak of light' a bright arc of light appeared between the broad part of the 'cap' and the sun's limb. The sun was now clouded for about a quarter of a minute, and when the cloud had opened the 'cap' had disappeared, and Venus had become truly circular, and was well separated from the limb of the sun."

At Mornington the late Professor Wilson noted a *fluffy connection,* which is undoubtedly the same phase I noted as *smoky connection.*

At egress the atmosphere was more disturbed in Melbourne, and the phenomena about internal contact were more marked and troublesome. First, a haze or smoky appearance between limbs of sun and planet was noted, then a distinct darker thread in centre of haze, then a tremulous or flickering junction of limbs, and finally a distinct and final junction. The sun's edge was very tremulous, but the sky quite clear.

Professor Wilson stated of this phase that "the sun's edge was boiling. Venus did not look round, but as you might imagine a spherical balloon not quite blown up; the edge looked crumpled. A small dark object was seen flickering backwards and forwards between Venus and edge of sun; this increased, and there was no other phase to which I could attach a definite time."

At Sandhurst, the appearances of internal contact at egress were noted by Mr. Moerlin, observing with a six and a-half inch refractor. (Cloudy weather prevented observation of ingress observations.) "As the planet moved gradually near the sun's limb, the sun's limb and planet appeared sharp and well defined, and the streak of light between the two was distinct and unmistakable. As it came nearer and nearer, the same appearance was witnessed without any change whatever, the streak of light between the two became smaller, and all at once a sort of triangular-shaped connection between the two took place, an appearance which I have seen with the artificial transit, but to a more limited extent, the base of the triangle on the sun's limb and the apex on the planet as thus :—



The difference in the appearance from what I had seen with the artificial transit consists in the much larger base. When this phenomenon first appeared the time was taken by Mr. Pirani, by chronometer 806 (Daniel's), viz., 3 h. 26 min. 54·3 sec. The planet every once in a while jumped off the apex of the triangle, and the rim of the sun's disc could be distictly seen between the two; the distance, however, betwen the triangle and the planet—when jumping—growing less. I now looked out for the tangential contact, watching at the same time the gradual diminution of the separation between the planet and the apex of the triangle; the clouds became thicker, but still permitted me to see the phenomenon distinctly, and what I considered the tangential contact was observed at 3 h. 27 min. 17·8 sec. The jumping or separating of the apex of the triangle and the planet ceased a few seconds before what I considered the tangential contact."

Mr. Todd says, respecting this phase, that "it was quite clear at egress, which was well observed. No black drop, but the continuity of the sun's disc was first broken by an exceedingly fine black line, or rather a minute speck, which appeared as the smallest possible protuberance on the edge of the planet, but the apparent contact occurred 12 seconds later. The planet was seen to be sensibly but very slightly distorted immediately joining the sun's limb, the circular outline of the ball being apparently drawn out into a thick band. This, however, was so slight, that it might easily have escaped notice."

Mr. Gilbert, at Glenrowan, reports of the appearances at internal contact of egress:—"The ligament commenced to form at 11 h. 58 min. 53 sec. a.m., Melbourne time, being exceedingly well defined a minute afterwards; the ligament snapped very suddenly about 0 h. 0 min. 44 sec. p.m. Shortly after this clouds came over, but still it was sufficiently clear to note anything of interest. About 2 p.m. noted that the planet appeared of a violet colour from the limb, extending a quarter of its diameter inwards; colour most dense at the limb of the planet, the centre being almost black. During the whole of the time the planet had a granular appearance."

Observations of the appearance of Venus during the middle phases of the transit, for the purpose of ascertaining if there were any indications of an atmosphere about Venus, and for noting any peculiarity of appearance of the planet's disc, were obtained by most of the observers. No evidence of a satellite was noted by any. Nearly all noticed a blue colour about the outer circumference of the disc of the planet, many of them stating it to be very marked, always *blue* or *indigo*. A light shade (by some called *grey*, by others *white*) was also clearly seen on the central portion of the disc, some observers stating it was condensed at the centre almost to a nebulous point of light. The Rev. J. Clarke, at Williamstown, observing with a eight and a-half inch Browning Newtonian, describes the appearance of a *brownish halo* encircling Venus while traversing the sun's disc. I made a very careful scrutiny, and the blue colour of the outer portions, and hazy light, denser towards the centre of Venus, were very well seen. I also noted a "blurring" or "loss of definition" of the "Rice grain" or "willow leaf" structure of the solar surface immediately around Venus. This blurring was not symmetrical, but projected towards the sun's south limb. Perhaps Mr. Clarke's halo may have some connection with this.

These are the most noteworthy facts recorded during the observation of the transit. They afford plenty of pabulum for speculation, but I simply place them in their bare form before you, partly with a view to inform you of what was seen, and partly that they may, with any remarks they may elicit, be recorded in our transactions whilst the circumstances are fresh in our memories.